

REMARKS

Claims 1-11 and 23-26 are currently pending in the present application.

Pursuant to the Restriction Requirement dated April 1, 2009, Applicants have canceled claims 12-22 and 27-28, without prejudice to the filing of one or more divisional applications directed to the subject matter thereof.

Claims 5-11, 23 and 25-26 have been withdrawn from consideration by the Examiner pursuant to the Restriction Requirement, as indicated at Item 4a of the "Disposition of the Claims" in the Office Action. Applicants have amended withdrawn claims 5-11 in conjunction with the amendments made herein to claims 1-4, and further request reconsideration of the Restriction Requirement, in light of the amendments, rejoinder and subsequent examination of claims 1-11 and 23-26 on the merits.

More specifically, *Applicants have amended independent claims 1, 5 and 9 to more particularly point out and distinctly claim various embodiments of Applicants' invention comprising articles wherein a tantalum film having the recited microstructure and characteristics is formed directly on a substrate surface.* As explained below, Applicants submit that the direct formation of the claimed tantalum films on a substrate surface without an intervening or interposing seed layer, is novel and non-obvious. Accordingly, Applicants respectfully submit that the special technical feature of the claimed articles, *i.e.*, tantalum films formed directly upon a substrate surface, establishes the requisite Unity of Invention under PCT Rule 13.1 such that pending claims 1-11 and 23-26 are properly examined together without restriction.

Applicants respectfully submit that the amendments made to claims 1, 5 and 9 are supported in the Specification, for example, at page 1, lines 8-14 and at page 11, lines 21-28 with reference to Figures 1(a) and 1(b), wherein the tantalum films are "formed directly" on the substrate. The amendments made herein introduce no new matter. Additionally, a complete listing of all claims ever presented is set forth herein in accordance with 37 CFR §1.121(c)(1). Entry of the amendments made herein is respectfully requested.

In the Office Action, the Examiner rejects claims 1-4 under 35 U.S.C. §102(b), as being anticipated by the Zhang, *et al.* reference, entitled “Formation of low resistivity alpha Ta by ion beam sputtering,” J. Vac. Sci. Technol., Volume B 21(1), Jan/Feb 2003, pages 237-240 (“Zhang”). Applicants respectfully traverse the Examiner’s rejection and the arguments and contentions set forth in support thereof for at least the following reasons.

As clearly described in Zhang, in order to prepare the low resistivity tantalum films described therein, Zhang describes the necessity of providing a chromium underlayer of at least 20 Å in thickness. Zhang states that “experimental results indicate that the Cr underlayer plays an important role in  $\alpha$ -Ta formation and that the critical thickness of Cr is 20 Å.” (See, Zhang, Abstract).

As noted above, Applicants have amended the present claims to specify that the nanocrystalline and amorphous tantalum films of the present invention are deposited directly on a substrate surface. In other words, there is no intervening chromium layer of at least 20 Å in thickness present in Applicants’ claimed articles. Thus, Applicants respectfully submit that for at least this reason Zhang fails to teach each and every element of Applicants’ claimed invention with the requisite specificity necessary to support an anticipation rejection under 35 U.S.C. §102. Reconsideration and withdrawal of the rejection based on Zhang are respectfully requested.

In the Office Action, the Examiner rejects claims 1-4 and 24 under 35 U.S.C. §102(a), as being anticipated by the Yuan, *et al.* reference, entitled “A new method for deposition of cubic Ta diffusion barrier for Cu metallization,” Thin Solid Films, Volume 434, pages 126-129 (2003) (“Yuan”). Applicants respectfully traverse the Examiner’s rejection and the arguments and contentions set forth in support thereof for at least the following reasons.

As discussed above, Applicants’ claimed invention has been amended to specify that the tantalum film is deposited directly on the surface of the substrate. As described in the Yuan reference, in order to prepare the tantalum or tantalum-based films described therein on the substrate, an amorphous interlayer of tantalum nitride is first deposited upon which an  $\alpha$ -tantalum phase is then disposed. For at least this reason, the Yuan reference fails to anticipate

the claimed invention, as amended herein. Reconsideration and withdrawal of the rejection are respectfully requested.

In the Office Action, the Examiner rejects claim 24 under 35 U.S.C. §103(a), as being unpatentable over Zhang, in view of the Chen, *et al.* reference, entitled “Phase formation behavior and diffusion barrier property of reactively sputtered tantalum-based thin films used in semiconductor metallization,” Thin Solid Films, Volume 353, pages 264-273 (1999) (“Chen”). Applicants respectfully traverse the Examiner’s rejection and the arguments and contentions set forth in support thereof for at least the following reasons.

Initially, Applicants submit that neither Zhang, nor Chen, nor a combination thereof, teaches or suggests each and every element of Applicants’ claimed invention. Specifically, there is no teaching or suggestion in either Zhang or Chen to form a nanocrystalline or amorphous tantalum film, as claimed, directly on the surface of a substrate without an intervening or interposed layer such as the chromium described in Zhang. Moreover, there is no teaching or suggestion nor any reason articulated by the Examiner which would motivate one of ordinary skill in the art to modify Zhang and Chen, as would be necessary in order to arrive at the claimed invention. There is nothing in either reference which would lead one of ordinary skill in the art to forego the deposition of an intervening or interposed sublayer prior to the deposition of a tantalum film, as claimed. Moreover, one of ordinary skill in the art would have no reasonable expectation of successfully doing so without the expressly taught sublayer provided in the references.

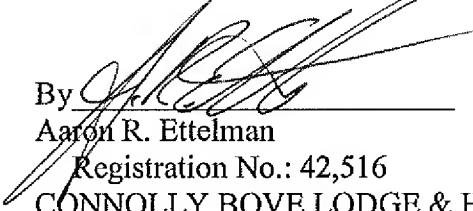
Accordingly, Applicants respectfully submit that the cited combination of Zhang and Chen fails to satisfy the criteria necessary to establish *prima facie* obviousness. Reconsideration and withdrawal of the rejection are respectfully requested.

In conclusion, Applicants respectfully submit that all pending claims patentably distinguish over the prior art of record. Reconsideration, withdrawal of the rejections and a Notice of Allowance for pending claims 1-11 and 23-26 are respectfully requested.

Respectfully submitted,

**JAGDISH NARAYAN, et al.**

Dated: September 9, 2009

By 

Aaron R. Ettelman

Registration No.: 42,516

CONNOLLY BOVE LODGE & HUTZ LLP

1007 North Orange Street

P.O. Box 2207

Wilmington, Delaware 19899

(302) 888-6435

(302) 658-5614 (Fax)

E-mail: aettelman@cblh.com